Analysis of the Development of VR (Virtual Reality) Based Interactive Learning Media Assisted by MilleaLab to Improve Learning Outcomes on the Material of Free Fall Motion Class XI in SMA Bengkulu City

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Abstract

The purpose of this research is to analyze the needs to find out how necessary the development of interactive learning media based on Virtual Reality assisted by millealab in physics lessons for students and teachers. The method used is a qualitative descriptive method. The instruments used in this research are observation sheets, interview sheets, and accompanied by documentation. Based on the results of the study, it was found that because the learning media used during the learning process was still simple such as printed books, power-points, and animated videos, which caused students to be less interested and feel bored with the lesson because, the media was less interesting. As a result, student learning outcomes still need to be improved. Based on literature and field analysis that has been conducted in high schools, namely SMA Negeri 1 Bengkulu City, SMA Negeri 3 Bengkulu City, and SMA Negeri 9 Bengkulu City need or approve the development of interactive learning media based on Virtual Reality (VR) to improve the learning outcomes of high school students in physics subjects.

A. Introduction

Education is a field that can be used for learning. A process for acquiring knowledge, skills, and habits that are passed on from generation to generation through instruction, training, or research is known as education. Creating, evaluating, and changing what is taught are the tertiary regulatory mechanisms through which education occurs (Letiche et al., 2023). In the current era, education that has been implemented focuses on 21st century education. In 21st century education, technology is developing very rapidly and has an impact on learning (Banarsari et al., 2023).

The transformation of the world from international to global, making global problems that occurred in previous years seem to have disappeared (Axelsen, 2022). The COVID-19 pandemic is a global problem affecting many sectors, including Education (UNESCO, 2021). Synchronous online learning was used around the world as a substitute for face-to-face classes during the height of the COVID-19 pandemic (Alhaider, 2023). From the sudden transition to online learning without any preparation, it is expected that educators and learners can quickly familiarize themselves with the new type of technology (Bozkurt & Sharma, 2020).

This is in accordance with the changing curriculum which is inseparable from the development of a digital age. The current era of digitalization is one of the starting points for the emergence of the Merdeka curriculum (Manalu et al., 2022). The purpose of the Merdeka curriculum is to train students' independence in thinking. Nadiem has a reason for making Merdeka learning policy, where based on the results of the

2019 Program for International Student Assesment (PISA) research, it shows that the assessment of students in Indonesia only ranks sixth from the bottom (Khoirurrijal et al., 2022).

Based on the results of the data collection process including documentation, observation, and interviews that have been conducted at SMA N 1 Bengkulu City, SMAN 3 Bengkulu City, and SMA N 9 Bengkulu City, it is found that there are several problems that exist in these high schools. The school has sufficient facilities and infrastructure, such as teaching materials and facilities. However, the network is not very optimal, the majority of students still use private networks. Teaching that has been done before by the teacher is always the main concern, because students usually get more information from the teacher than from the students themselves and also still use more printed teaching materials. In addition, teachers also only use simple learning media during the learning process such as printed books, PowerPoint which is still monotonous without any moving animations, and animated videos. However, it is less interesting and less interactive. This is because teachers do not have much time to make more interesting learning media. And based on the results of interviews conducted with physics teachers who teach in grades X, XI, and XII at the high school, it is known that the lack of learning media resources available to students in physics. Some students still think physics is a difficult subject, they often have difficulty in understanding abstract and mathematical physics such as formulas in physics if it is different from the form of the situation being taught. Physics learning outcomes obtained by students also still need to be improved.

Based on observations also obtained about the physics learning process in three schools is still less interactive and still focuses on teacher-dominated learning patterns, in the physics learning process still lacks the use of learning media due to lack of time for teachers to make interesting learning media. The potential of students, especially thinking creativity during learning, has not gone well. As a result, student learning outcomes are also not optimal. The physics learning completeness category at the school is 80, but many students achieved scores below this category. In general, only 41% of students met the criteria.

Physics is one of the branches of science which is a science that develops through observation, formulating problems, formulating hypotheses, testing hypotheses through experiments, drawing conclusions, and discovering theories and concepts. Often physics is considered a difficult discipline and difficult to understand (Berge et al., 2020). Physics is closely related to formulas that make students think physics is a difficult lesson because it is filled with formulas that must be memorized and applied in many different situations. As a result, students feel bored and less interested in physics lessons. If this continues to happen, it will result in a decrease in student learning outcomes due to students' lack of understanding of the material (Paoliana et al., 2020). The subject matter of physics that has a formula and must be understood is vertical motion. One of the topics in vertical motion is falling motion. Free fall motion is the downward movement of an object without any initial velocity (Agustinasari & Sumarni, 2021).

Learning outcomes are measurable statements that describe educational objectives in terms of knowledge, skills, and competencies of students after learning (Kowalska et al., 2022). Thus, good physics learning outcomes are very important for learning in schools (Yanto & Putra, 2020).

One way that can be used to overcome student difficulties with physics subjects is to use media in learning activities. Media utilization is very important to improve students' cognitive learning outcomes (Vilmala & Mundilarto, 2019). One of the innovations to make learning today more effective and efficient is the development of learning media, which is also an important part of the learning process, and it should be directed towards meaningful learning that encourages students to enter the 21st century (Daryanes et al., 2023). Learning media is a tool or means that allows learning resources to convey messages to students more easily. In order for the learning process to be successful and interesting for students, teachers must use interactive media (Pulungan, 2021).

Virtual reality is one of the learning media that can keep students interested and make them interact while learning (Andam et al., 2023). Virtual reality (VR) is a three-dimensional digital environment that gives users varying degrees of freedom in interaction and immersive interaction (Lamb, 2022). As such, virtual reality (VR) can help education by increasing student participation and encouraging them to learn (Makransky & Lilleholt, 2018). In the world of virtual reality, collaboration can reduce the cognitive load caused by the virtual environment. In addition, by providing the right roles and resources, VR also serves as a context for collaborative problem solving (Wang et al., 2021). In recent years, virtual reality (VR) has become more popular in schools or educational institutes. Its presence and exciting features open up new opportunities for learning (Villena-Taranilla et al., 2022).

Millealab is one of the platforms that can be used to develop virtual reality-based learning media with a variety of more specific features that aim to create good reality visualization to support the learning process

(Agusty & Anggaryani, 2021). According to Millealab in (Sudiarno & Maulana, 2021), millealab is a virtual reality simulation development application that can be used to create VR-based educational content.

Research that is relevant to this research is research conducted by (Kartikasari & Anggaryani, 2022) in his journal entitled "*Development Of Virtual Reality Endogen Energy (VREE) Media For Physics Learning Mechanical Wave On Class XI*" In this study, Virtual Reality Endogenous Energy (VREE) media was developed, it was found that the use of virtual reality-based learning media with the help of millealab on mechanical wave material was interactive and feasible to use. However, they recommend that there is a need for virtual reality development with the help of millealab on other materials.

The difference between this research and previous research is that virtual reality-based learning media developed by researchers with free fall motion material and used to measure student learning outcomes while previous research on mechanical wave material and to measure student motivation to learn physics.

Based on the problems that have been conveyed above, researchers manila that an interesting learning media based on virtual reality with the help of millealab is needed which aims to facilitate learning and improve student learning outcomes in physics subjects, especially in free fall motion material. Therefore, this research was conducted with the title "Analysis of VR (Virtual Reality) Based Interactive Learning Media Development Assisted by Millealab to Improve Learning Outcomes on Class XI Free Fall Motion Material at SMA 3 Bengkulu City".

B. Research Methods

This research is qualitative descriptive research. Descriptive research is a type of research that aims to provide systematic and accurate information about symptoms, facts, or events related to the characteristics of a particular population or area (Hardani et al., 2020). Qualitative research methods are carried out on natural objects. which develops naturally without being manipulated by researchers and influenced by researchers (Sugiyono, 2020). According to (Rusandi & Rusli, 2021) Qualitative descriptive research displays data as it is without manipulation. The purpose of this research is to provide a complete description of the events that occur or to reveal and explain the phenomena that occur.

The samples of this study were SMAN 1 Bengkulu City, SMAN 3 Bengkulu City, and SMAN 9 Bengkulu City with the object of physics teachers and students majoring in science in these schools. In this study, sampling was done by purposive sampling. Purposive sampling is a technique of determining the sample using certain considerations (Sugiyono, 2020).

The research was conducted at the beginning of the odd semester of the 2023/2024 academic year at SMAN 1 Bengkulu City, SMAN 3 Bengkulu City, and SMAN 9 Bengkulu City. This research was conducted from June to July 2023.

The implementation of this study began with determining the research subjects, namely physics teachers and students majoring in science. Furthermore, researchers compiled research instruments in the form of observation sheets and interview sheets for teachers and students. researchers conducted observations and conducted interviews with teachers and students directly in three schools. The next step is to analyze the percentage of how necessary virtual reality-based learning media assisted by millealab for teachers and students.

This research uses qualitative data collection techniques, namely through observation, interviews, and accompanied by documentation. The instruments in this study consisted of observation sheets, interview sheets, and accompanied by documentation.

The limitation of this study is that it lies in the insufficient number of respondents so that it can be an obstacle to convey the actual situation, this is due to the limited number of responses, so that it cannot represent the population as a whole. The results of the study were also affected by the respondents' ability to understand the statements in the questionnaire. In addition, due to the limited time, energy, and ability of researchers also affect the quality of research.

C. Result and Discussion

Based on the results of interviews with physics teachers conducted at SMAN 1 Bengkulu City totaling 2 people, SMAN 3 Bengkulu City totaling 1 person, and SMAN 9 Bengkulu City totaling 1 person. The first indicator of facilities and infrastructure, the majority of teachers' answers for the internet network at school is limited to the teachers' room, library and computer lab. In addition, the internet network has not been

accessible to students, so they have to use their own internet network or data package. Facilities such as projectors provided by the school have been used by teachers for in-class learning.

The second indicator of the learning process, teaching materials used by teachers are still dominantly in printed form, while non-print media used in the learning process such as PowerPoint. Teachers use simple learning media, usually for evaluation, and learning videos combined into PowerPoint. In learning, teachers use lecture, discussion, question and answer, and experimentation methods. The learning method is adjusted to the material being taught. Thus, there are students who have been actively involved during learning activities, but there are also students who are motivated to learn physics, so they are less active in learning. In addition, the physics learning outcomes obtained by students also still need to be improved because there are still students who have difficulty understanding physics equations and formulas.

The third indicator is school policies such as communication tools and study hours. Before the pandemic, schools did not allow students to bring communication devices such as smartphones to school. However, after the pandemic, students began to be allowed to bring their smartphones to school to adjust learning during the COVID-19 pandemic, with a note that students can only take out their smartphones when there is a command from the teacher to help learn the subject matter taught by the teacher. Meanwhile, the physics learning hours in the three schools are also the same, namely 3 meetings a week.

Based on the results of interviews with physics students conducted at SMAN 1 Bengkulu City totaling 9 people, SMAN 3 Bengkulu City totaling 6 people, and SMAN 9 Bengkulu City totaling 6 people, it was found that in the first indicator, namely facilities and infrastructure, the average answer of students was that the internet network was only available in certain rooms such as the teacher's room, computer laboratory room, and library.Meanwhile, students use private networks.Computer laboratories are already available at school, but there are variations in their use.Some have used it, some have never used it or have never been to the computer laboratory.School facilities such as projectors in physics learning have been used. Some students think that using it can help in understanding learning materials.

The second indicator is the learning process, it is found that the average student answer in physics learning, teachers still dominantly use printed teaching materials, while students prefer printed teaching materials compared to non-printed teaching materials because in learning they still use a lot of printed teaching materials compared to teaching materials that are already technology-based but these students support teachers to use technology-based learning media, besides that students also support learning media that are arranged clearly and systematically and learning media in the form of visuals such as images, graphics, videos, and animations so that these students will use if technology-based learning media are available such as visual media that can support students in understanding physics material. Learning media in schools need to be developed to make it easier for students to understand the material. In physics material, the school rarely uses group discussions or collaborative activities to understand the physics material, while students prefer more interactive learning for example through experiments or group discussions so that students need media that helps to better understand, analyze, explain, or reapply physics material.Students experience difficulties in the physics material applied by the teacher, one of which students have difficulty in the calculation and physics formulas.

The third indicator, namely school policy, found that in this school students are allowed to bring or use a Laptop/Handphone during the learning process according to the teacher's permission in class.Physics learning activities carried out in class are 3 meetings per week.

In addition, based on the results of observations made in three schools in accordance with the results of interviews with teachers and students that in each indicator the same as mentioned in the results of the interview above, where the physics learning process in three schools is still less interactive and still focuses on teacher-dominated learning patterns, in the physics learning process still lacks the use of learning media due to lack of time for teachers to make interesting learning media.Student potential, especially thinking creativity during learning, has not gone well. As a result, student learning outcomes are also not optimal. The physics learning completeness category at the school is 80, but many students achieved scores below this category. In general, only 41% of students met the criteria.

This research is supported by research conducted (Kartikasari & Anggaryani, 2022) in their journal *"Development Of Virtual Reality Endogen Energy (VREE) Media For Physics Learning Mechanical Wave On Class XI".* In this study, Virtual Reality Endogen Energy (VREE) media was developed, in the study it was concluded that the VREE learning media developed was feasible to use, the validators generally stated "very interested" in learning media using millealab. In addition, the VREE learning media has also been tested in limited trials. The results of the limited trial showed that 100% of students agreed that the media

display was attractive, about 95% of students also agreed that VREE media could motivate students to learn physics, and for student answers from the questionnaire met the criteria of "very good" with a percentage of 96.7%.

Virtual reality (VR) is a three-dimensional digital environment that gives users varying degrees of freedom in interaction and immersiveness. Interactive learning can encourage learning and provide a different understanding of spatial relationships compared to two-dimensional representations. In a virtual reality world, collaboration can reduce the cognitive load caused by the virtual environment. Moreover, by providing the right roles and resources, VR also serves as a context for collaborative problem solving.

D. Conclusion

Based on the results of the needs analysis conducted for the development of virtual reality assisted by millealab for Class XI Physics Free Fall Motion material, it can be concluded that teachers and students at SMAN 1 Bengkulu City, SMAN 3 Bengkulu City, and SMAN 9 Bengkulu City still need the development of virtual reality assisted by millealab to improve student learning outcomes.

In this study, the sample of students from science majors from three schools namely SMAN 1 Bengkulu City, SMAN 3 Bengkulu City, and SMAN 9 Bengkulu City. The limitation in data collection in this study is the limited number of respondents available, so that the atmosphere in the three schools is less illustrated. Therefore, future researchers should use a sufficient number of respondents to describe the atmosphere in the school clearly.

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